As provided in the case of a second implementational variant of this invention, the individual (solid) body does not have to be produced completely from a metal compatible with the matrix metal of the foamed body which is forming, but rather a coating of the same which promotes material bonding may well suffice, although an integral bond of said coating with the basic body forming its substrate is important.

A1

The invention further comprises as a third variant a selection of materials, material phases, layers or the like coming into consideration for the effective bonding of the (solid) parts into the foamed metal body.

Delete the paragraph bridging Pages 4 and 5 and substitute therefor the following:

Likewise preferred special cases for the desired high degree of integration of the solid bodies or solid functional structural elements into the foamed metal are respectively shown by the fourth and fifth variants.

A2

Page 5, delete paragraphs 2-6 (lines 6-28) and the paragraph bridging Pages 5 and 6, and substitute therefor the following:

For cases where an intimate bond, as previously dealt with at length, between the foam and the body embedded in the same is not desired, or even subsequent removal of the body is to take place, the measures brought together in the first implementational variant of the invention may bring advantages.

There are in fact no limits to the techniques for applying the coatings promoting or else inhibiting the material bond between the matrix metal and the solid parts encapsulated in the foam of the same. Accordingly, a number of such coating technologies that are particularly preferred within the scope of the invention are mentioned in the second variant according to the invention.

The material bond, in itself essential and desired for most cases, can be supported in an advantageous way by measures for increasing the mechanical bond between the foamed metal and individual solid bodies, as provided for example by enlarging or specially shaping its surface, as provided according to the third preferred embodiment of the invention.

The solid bodies to be integrated into the foam may be produced for example by casting, continuous casting, extrusion molding, extrusion, rolling or the like. For certain cases, for example if the insert structural elements are to meet particularly high technological requirements, that is to say are to have, for

example, a high level of hardness, abrasion resistance, chemical resistance or the like, the use of solid bodies or structural elements of material produced by powder-technological means and compacted, for example sintered, is also possible.

Moldings or structural elements to be foam-encapsulated of materials with melting temperatures which lie above the melting temperature of the metal of the basic body to be expanded are preferably used.

Delete the paragraph bridging Pages 5 and 6 and substitute therefor the following:

A major advantage of the novel process of in situ foaming consists in that the structures, bodies or functional structural elements to be integrated onto or into the foam of the matrix metal are introduced into the shaping mold together with foamable semifinished bodies, which have essentially a geometry which is similar to the geometry of the finished composite product obtained after foaming.

Page 6, delete the second complete paragraph and substitute therefor the following:

The invention includes a first preferred process variant in which the retaining elements serving for an exact positioning of the solid parts as it were „go into" the foam matrix, or the like, in other words can be genuinely material-integrated into the same.

Page 6, delete the last paragraph and substitute therefor the following:

Retaining elements, whatever form they take, with a higher melting temperature than that of the matrix metal forming the foam are preferred.

Page 7, delete paragraphs 1-5 and the paragraph bridging Pages 7 and 8 and substitute therefor the following:

If it is intended to produce particularly robust sandwich foamed metal bodies with metal sheets or foils respectively bounding the foamed metal bodies above and below or on both sides, which lends the molding particularly high mechanical stability, it is favorable to arrange in the foaming and shaping mold foils and/or metal sheets of this type at the corresponding locations of the in the desired position. This provides the advantage that, for example, an "upper" covering foil or a coverage sheet of this type is not arranged, as previously, directly on the body of compacted metal matrix/foaming agent semifinished product

arranged on the first sheet, this sheet or foil then being lifted by the foamed metal itself, with increasing pore formation and pore volume enlargement, during the development of the foam, and finally pressed against the top of the mold. Rather, this upper covering foil or upper covering sheet is arranged right away such that it is in the proximity, of, or bears against, the top of the mold, for example by means of appropriate foil holders, so that the aimed for welding with the foamed metal reaching it during the foaming process takes place right away in the desired, exact position.

To obtain a solid body/foamed metal composite molding that is virtually optimum, requires a minimum of finishing effort and is in the final form and final dimension, the charging of the foaming and shaping mold adjusted to match the final form is particularly favorable. In the way specified there, integral foam structural elements of the novel type with largely homogeneous pores can be achieved.

For the production of foamed-metal moldings having pore fractions, pore densities or pore volumes varying locally in regions of their volume, the type of mold charging with the bodies of the foamable semifinished product provided according to the second variant of this claim brings advantages.

For achieving moldings with optimum bonding-in of the solid bodies, it has proven to be particularly advantageous to maintain ratios between the volumes or the total volume of the compacted, foamable semifinished bodies introduced into the mold and the cavity of the shaping mold.

The invention is not in any way restricted to "full" solid bodies, but rather the incorporation of hollow solid bodies, that is to say bodies which are hollow but virtually solid surrounding walls, may also be provided.

A further advantageous possibility consists in that foamed metal bodies are created with clearances, cavities or the like which are accessible from the outside or, for example, also pass through them, which on the one hand saves such empty spaces from subsequently being introduced, but on the other hand has the advantage that the hollow bodies forming the limitation of the empty spaces there provide a significant mechanical reinforcement together with the foamed metal surrounding and integrating them. For example, straight tubular bodies from one wall to the opposite wall of the mold can be foam-encapsulated there tight or, for example, bent tubular bodies from one wall to a neighboring wall of the mold.

Page 8, delete the second complete paragraph and substitute therefor the following:

Finally, the invention relates to the composite foamed bodies produced by the novel process.

Page 8, delete the second paragraph and substitute therefor the following:

In order on the one hand to allow for as high surface area as possible for the contact of the foamable compacted semifinished material with the mold or mold base provided for heating up, shaping and dimensioning the latter, and on the other hand to avoid undesired slipping or uncontrolled rolling away of the semifinished bodies during manipulation of the mold, and consequently irregular or undesired material density distribution in the mold before foaming, it is favorable according to a third variant [of claim 9] to provide a semifinished material with bodies with at least one flat or planar resting side, that is to say underside, by which these semifinished bodies rest on the mold base or a composite metal sheet placed in said mold.

Page 13, delete paragraphs 2 and 3 and substitute therefor the following:

DETAILED DESCRIPTION OF THE DRAWINGS

The invention is explained in more detail with reference to the drawing. Figure 1 shows particularly preferred forms of profiles of the foamable semifinished product to be used, produced by compacting metal powder and foaming-agent powder; Figure 2 shows the diagram of a mat formed with said semifinished bodies and Figure 3 shows a diagram of a mold charged in a suitable way for carrying out the process according to the invention.

DETAILED DESCRIPTION

Figure 1 shows in an oblique view three forms of foamable semifinished bodies 60 to be used according to the invention which are particularly preferred within the scope of the present invention, to be precise one with a flat rectangular cross section, one with a more than semicircular cross section and one with a square cross section. At least one of the side faces, denoted in the drawings by 601, is essentially planar and flat, the other faces may have any shape, that is to say be for example convexly curved or formed in some other way. An advantage of the planar faces 601 is that the semifinished bodies 60 can bear with large surface-area contact against the base of a mold or against a sandwich sheet fitted in said mold, the risk of locational displacement or slipping during movement or manipulation of the mold being significantly reduced. A further major advantage is that an improvement in the heat transfer from the mold base into the semifinished product 60 is also achieved by this planar face 601.

Delete the paragraph bridging Pages 13 and 14 and substitute therefor the following:

Figure 3 shows in a diagrammatically schematic form an inner space 112 of a foaming and shaping mold 100 advantageously charged within the scope of the invention: lying on the -here flat - moldbase 11 is a lower solid bottom sheet 670 for the formation of a foamed metal/solid metal composite body, on which semifinished bodies 60 based on extrusion-molded compacts of a metal powder, for example Al powder, and a foaming-agent powder, for example TiH powder, are arranged with their flat sides 601, then forming the matrix foamed metal when the foaming temperature is reached. A curved composite sheet 671, which is ultimately welded material-integrally with the matrix foamed metal 610 expanding when the mold 100 is heated, is held in position against the concavely curved top 12 of the mold by means of the supporting bodies 620, supporting themselves from below, for example hollow cylinders or the like advantageously of a metal which can be solubilized from the foamed metal or breaks up in it and melts at a somewhat higher temperature.